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FIELD STUDIES OF THE USE OF INSULATION IN BROILER HOUSES IN CENTRAL MISSISSIPPI

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INTRODUCTION

This report is on research conducted in Central Mississippi from September 1962 to February 1964 into the role of poultry house design in broiler condemnation losses.

Since more than half of the condemned birds are condemned for respiratory defects, mainly airsacculitis, the environment, especially temperature, seems to play a very improtant part in the respiratory trouble. Consequently, the overall respiratory problem might be alleviated by the use of insulation in the broiler houses so that the temperature inside the broiler house can be controlled to some extent. Also, the use of insulation might eliminate the moisture problem and thereby help eliminate some of the other stressing factors.

PROCEDURES

Studies were started in September of 1962 to determine if insulating some commercial broiler houses would help maintain better environmental conditions and thus reduce condemnation losses. These studies were made on six different farms. On four of these farms (A, B, C, D in table 1) there was one house with insulation in the roof or in the roof and end wall, and one comparable house with no insulation. Each of the other two farms had three broiler houses. The houses on one of these farms had insulated roofs and end walls; the houses on the other farm had no insulation but were comparable in all other respects. These two farms are referred to as one farm (E) throughout this report so that their houses may be discussed in the same manner as are the houses on farms A through D. The houses on all of the study farms are further described in table 1.

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Recording hygrothermographs were placed in the houses approximately 12 inches above the litter. Black globe and roof or insulation surface temperatures, as well as air movement measurements, were taken occasionally. Recording thermometers were placed at the edge of the canopy of a brooder in some of the houses to check the wintertime brooder temperature.

The cooperator (usually the feed company) was asked to handle the birds and feed in such a manner so as to obtain comparable data from each of the two houses on the farm. This was not always done.

The caretaker, under the supervision of the serviceman, regulated the ventilation and brooder temperature adjustments and performed the management practices. All houses had manually controlled, natural ventilation.

The following production and processing data were determined when possible: (1) average weight, (2) mortality, (3) feed conversion, and (4) condemnation. It was not possible to obtain all of these data on every group of birds grown, and many groups were grown on which no data were obtainable.

RESULTS

Production and processing data are given in table 2 for the winter grow out period (chicks started between October 15 and March 1), and for the summer grow out period (chicks started between May 1 and August 1). The birds from the same farm were normally sold at the same age, but the age of birds at market varied from farm to farm. Also, the age of birds at market during the summer and winter periods was not the same.

The data indicate that in most cases the birds had the highest average weight from the noninsulated house during the winter grow out period, but from the insulated house during the summer grow out period. The feed conversion during the winter was a little better in the insulated houses, but there was very little difference shown between the houses during the summer. During the winter grow out period, the condemnation rate was a little lower in the houses with insulation on three of the five farms (B, C, E), but it was about the same on the other two farms (A, D).

The security and disease spread prevention practices were poor. No precautions were used by the caretaker to prevent tracking disease organisms or parasites from one house to another. It does not show in the data, but it was observed that in most instances when a respiratory trouble started on a farm, it would start in the noninsulated house first. Only farm E had all the houses insulated or noninsulated, under the supervision of one caretaker. This farm had malfunctioning brooders, and the results shown here might not be indicative of what might be obtained with proper brooder operation.

Table 1. Descriptions of insulated test houses on study farms[1/]

Farm	House		Insulation			Brooding system	Sidewall		
	Dimensions	Normal capacity[2/]	Thickness	Type	Location		Height		Covering
	Feet	Chicks	Inches				Feet	Inches	
A	30 x 330	11,000	1	Mineral wool with aluminum-backed vapor barrier	R[3/]	Canopy	6	6	Cloth curtains
B	30 x 250	7,500	2	Mineral wool with aluminum-backed vapor barrier	R & E[4/]	Canopy	6	8	Cloth curtains
C	50 x 300	15,000	1	Expanded poly-styrene	R & E	Hot water	7	6	Woven plastic
D	40 x 300	12,000	1	Expanded poly-styrene	R & E	Canopy	7	0	Woven plastic
E	40 x 300	12,000	1	Expanded poly-styrene	R & E	Gas infra-red	7	0	Woven plastic

1/ Each insulated house on any particular farm had a noninsulated counterpart with which it was compared.
2/ Two percent of the normal capacity were placed in the houses as extras to compensate for deaths. Chicks were not culled at hatchery.
3/ Roof only.
4/ Roof and end walls.
5/ Farm E was actually two farms, each with three broiler houses. The houses on one farm were insulated; the houses on the other farm were not. These farms are referred to as one farm--farm E--in this study.

Table 2. Production values for insulated broiler houses minus the comparable values for noninsulated broiler houses[1/]

Farm	Average weight	Feed conversion[2/]	Condemned	Mortality
	Lb.	Lb./Lb.	Pct.	Pct.
WINTER GROW OUT PERIOD				
A	-0.16	+0.08	+0.1	-1.81
B	-0.04	-0.21	-0.4	+0.20
C	-0.06	-0.07	-0.5	-----
D	-0.02	-0.28	0	-1.56
E	+0.06	-0.14	0.70	0
SUMMER GROW OUT PERIOD				
A	+0.08	----	-0.40	-0.08
B	+0.04	-0.11	----	-0.39
C	+0.08	+0.05	----	----
E	-0.10	-0.02	+0.40	-0.05

1/ A plus sign before a number indicates that the insulated broiler house value was greater than the noninsulated broiler house value; a minus sign before a number indicates that the insulated broiler house value was less.

2/ Pound of feed per pound of bird.

The percentage of mortality was somewhat lower in the houses with insulation than in the noninsulated houses.

The temperature and humidity maintained in these study houses reveal that the conditions in the house with insulation in some cases were not much better than those in the noninsulated house (see appendix figures 1 to 3). During the winter, this was probably caused by three main reasons; namely, (1) excessive ventilation, (2) low "U" values of the side walls, and (3) type of brooders and their adjustment. The brooders used on three of the farms were gas canopy, cool room brooders. Excessive air change was caused by the poor condition and poor fitting of the sidewall curtains, the open ridge ventilators, and the improper curtain adjustments.

A good example of the effect the ridge ventilator has on the inside temperature was obtained from farm C. The houses on this farm had a continuous ridge vent that was opened on the south side of the house only. During the winter of 1962-1963 the vents on the houses were left open until February 14, 1963. The vent on the insulated house was closed on this date. The average daily low temperature and high relative humidity recorded in the two houses one week before and one week after the vent was closed were as follows:

House	Before		After	
	Temp.	R.H.	Temp.	R.H.
	°F.	Pct.	°F.	Pct.
Noninsulated	39.6	74.1	40.7	94.6
Insulated	43.7	70.6	53.4	60.6

Closing the ridge ventilator not only increased the average daily low temperature of the insulated house, but also decreased the relative humidity. According to the psychrometric chart, air at 40.7° and 94.6 percent R.H. has approximately the same amount of moisture per pound of dry air as air at 53.4° and 60.6 percent R.H. The birds were only two weeks of age at the time the vent was closed. The brooder temperatures in the houses on farms A, B, and D (fig. 3) show that the temperatures recommended by poultry specialists were not maintained. Sometimes the brooder temperatures varied widely from brooder to brooder. The thermostats on some of the brooders needed repairing or replacing.

The main advantage of insulation in summer was a cooler overhead surface, and therefore, less radiant heat load. Table 3 has the comparative black globe and air temperatures in the two houses at farm B. A little breeze blowing kept the temperature in the two houses about the same even when the black globe temperature was several degrees lower in the insulated house than in the uninsulated.

Broilers died from heat prostration only on farm B. One day 61 birds were lost in the noninsulated house on this farm before the roof was sprayed with water to help keep it cool. Only one bird was lost in the house with insulation. These birds were 8 weeks and 6 days old. The age of the birds at the time these extremely high temperatures and humidites occur seems to have a very important effect on mortality. The birds on the other farms were less than 7 weeks old at this time and there were no losses from the heat.

On one farm deaths were caused by low temperatures in the noninsulated house. If the brooders had been operating properly on this farm, the number of deaths might not have been so large.

Table 3. Black globe and air temperatures in broiler houses on farm B during summer period.

Date	Time of day	House[1]	Temperature			
			Air	Black globe[2]		
			---	1	2	3
			°F	°F	°F	°F
8/21/63	12:25 p.m.	N	88	98	99	96
8/21/63	12:25 p.m.	I	84	92	91	90
8/23/63	11:30 a.m.	N	90	98	97	95
8/23/63	11:30 a.m.	I	87	94	92	92
8/25/63	1:15 p.m.	N	92	100	100	99
8/25/63	1:15 p.m.	I	91	97	95	95
8/26/63	2:15 p.m.	N	95	101	101	99
8/26/63	2:15 p.m.	I	93	98	98	97
8/28/63	11:50 a.m.	N	91	101	100	98
8/28/63	11:50 a.m.	I	89	95	94	94
9/2/63	2:45 p.m.	N	91	100	99	99
9/2/63	2:45 p.m.	I	89	96	96	95

1/ N = not insulated; I - insulated.
2/ Globe 1 was located 6 ft. from south wall, 9 in. above litter.
Globe 2 was located in center of house, 9 in. above floor.
Globe 3 was located 6 ft. from north wall, 9 in. above floor.

A gas consumption comparison was made on four of the farms. Farms A, B, and D used liquefied petroleum gas, whereas farm C used natural gas. The saving on fuel in the house with insulation for the different farms was as follows: farm A, 27.7 percent; farm B, 22.0 percent; farm C, 3.6 percent; and farm D, 34.2 percent. This means a total saving of 400 to 500 gallons of fuel per year for farms A, B, and D. At eleven cents per gallon for fuel, this would mean a saving of approximately $45 to $50 per year for fuel. The boiler of the heating system for farm C did not function properly for several broods of chicks, and this probably is the reason for the low percentage of gas saving on this farm.

Only two different insulating materials were studied. These materials have not been in use on these farms long enough for their expected life to be determined.

The cost of installing different insulation materials varied widely (table 4).

Table 4. Labor costs for insulating the roof of a 40 by 300 ft. house.

Construction	Cost
	Dollars
1 in. polystyrene between sheathing slots and metal roof - New construction	$100 - $150
1 in. polystyrene board and battens beneath rafters.	$180 - $225
Blanket wool with separate vapor barrier supported on wires or bands.	$360 - $480
Batt wool with attached barrier supported on wires or bands.	$180 - $240

Rodents damaged severely the mineral wool insulation in the house on farm B. They stripped the mineral wool off the vapor barrier and carried it to the lower part of the roof near the plate line, where they bedded up in it. The wool was packed in this location and in many places the vapor barrier was ripped from the supporting tacks.

Some problems encountered in obtaining data in these field studies were: (1) Feed was carried to the farms in bulk trucks. One truck load of feed might be divided between the two study houses and the amount of feed put in each house was not known. (2) Birds from one house would be sold several days

earlier than birds from the other study house. (3) Birds from two comparable study houses would be mixed when loaded on a truck hauling them to the processing plant. (4) Birds from one house were sold to one processing plant, and birds from the comparable study house sold to another. Sometimes one or both of these plants were not inspected by USDA poultry inspectors. (5) The birds placed in the comparable study houses were not always comparable enough for reliable results.

The problems generally occurred because the cooperators had to keep production costs as low as possible. Also, they received requests from the different processing plants for the birds and had to furnish the birds whenever the plant managers specified.

SUMMARY AND CONCLUSIONS

Results from these field studies indicate the following:

1. Condemnation losses may be a little less during the winter in broiler houses with some insulation than in those without insulation.

2. Feed conversion may be a little better during the winter in houses with some insulation than in noninsulated houses.

3. Brooder fuel savings of 20 to 30 percent can be expected in partially insulated houses over noninsulated houses.

4. Ventilation control is essential for winter temperature control.

5. Caretakers enjoyed the extra personal comfort in insulated broiler houses both in winter and in summer.

6. Rodents can be an increased problem with insulation and a good control program should be followed.

7. Caretakers will have to make a change in their method of brooder and ventilation management in insulated houses in order to receive the greatest benefit from the use of insulation.

8. It is difficult with the present price of broilers and the cost of production to get the desired data as quickly as it would be desirable in field studies of this nature.

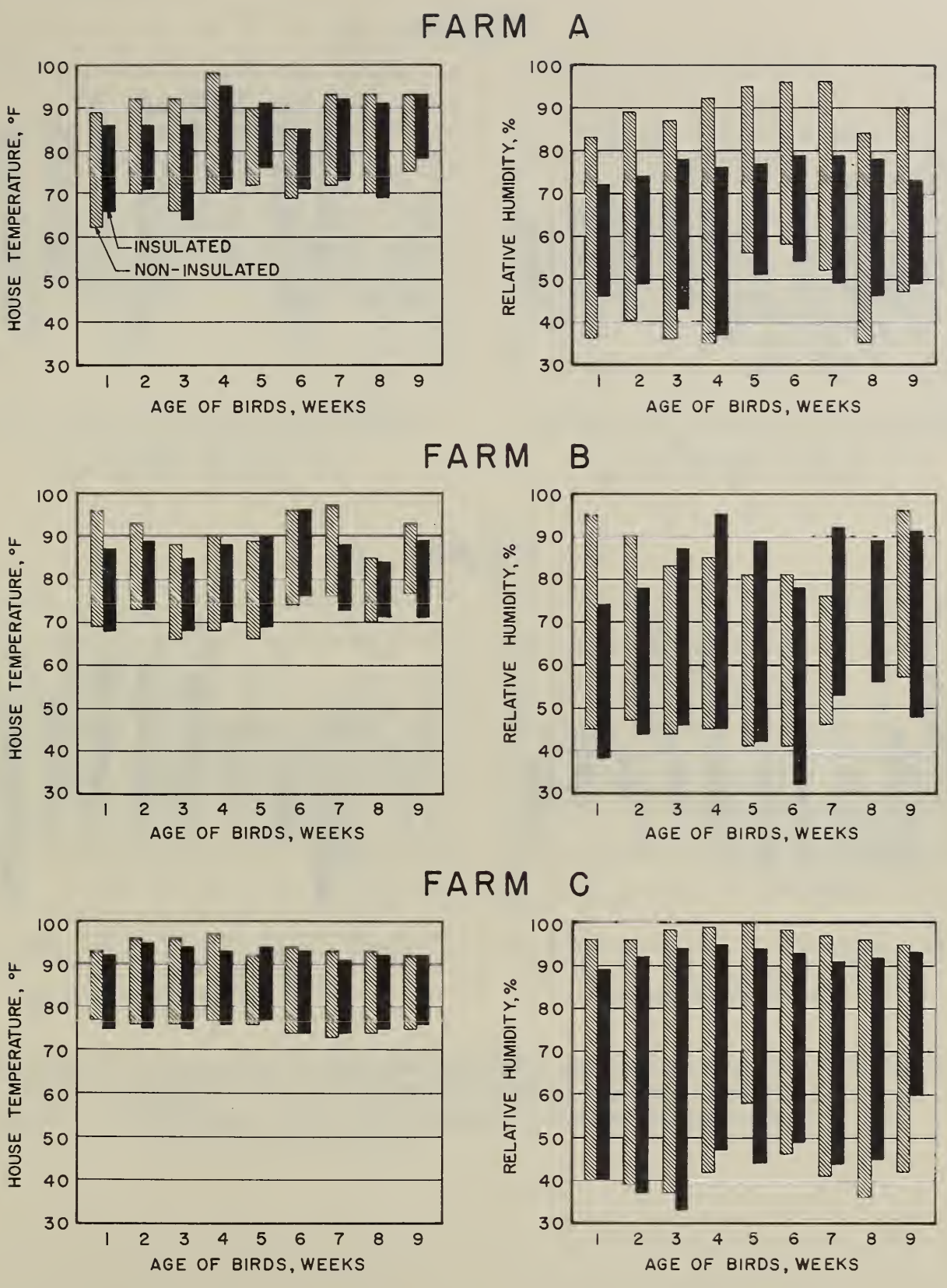

Figure 1. Comparison between non-insulated and insulated broiler house temperatures and relative humidities in the summer. Bars indicate the weekly average of the daily maximum and minimum.

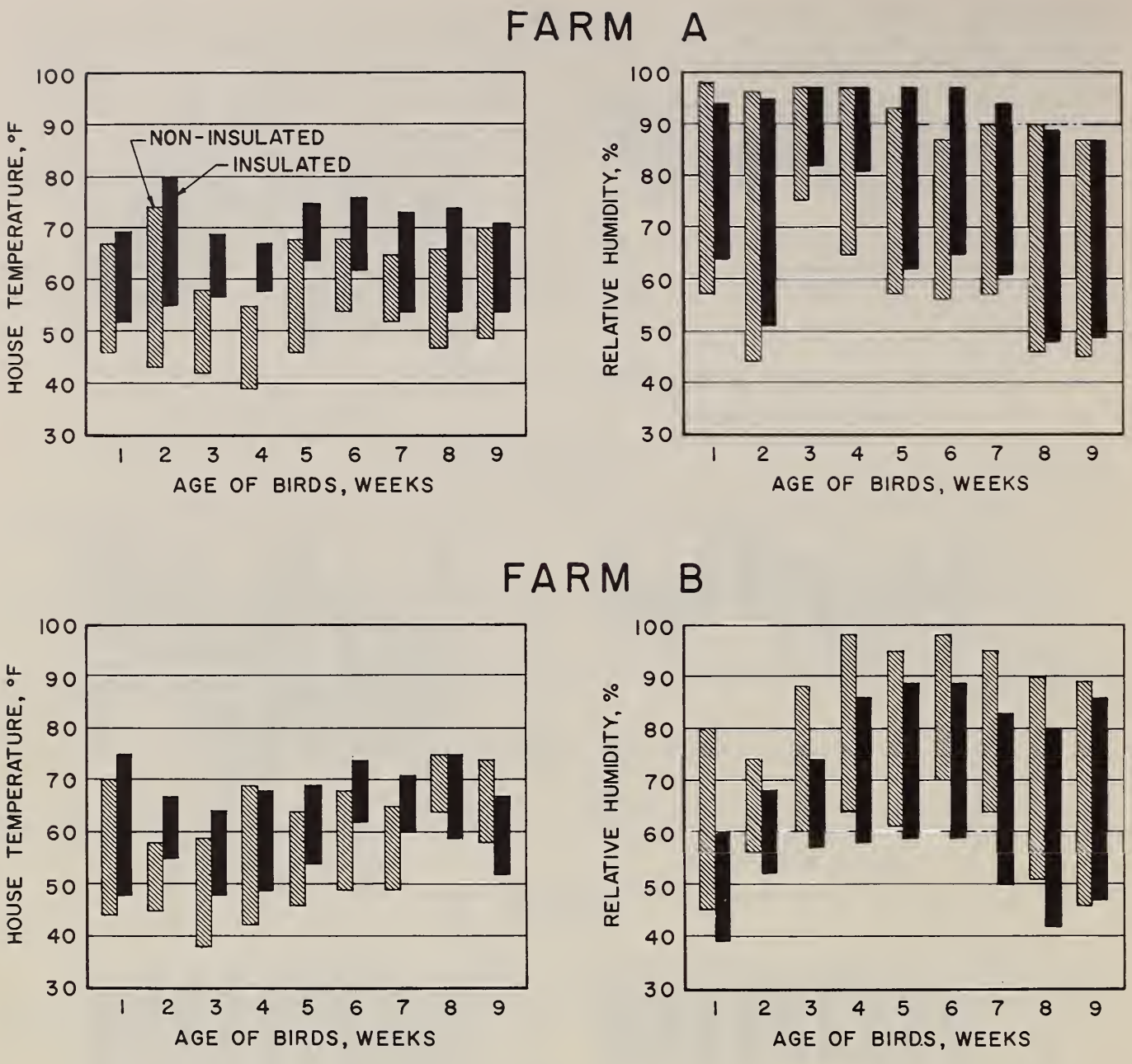

Figure 2. Comparison between noninsulated and insulated broiler house temperatures and relative humidities in the winter. Bars indicate the weekly average of the daily maximum and minimum.

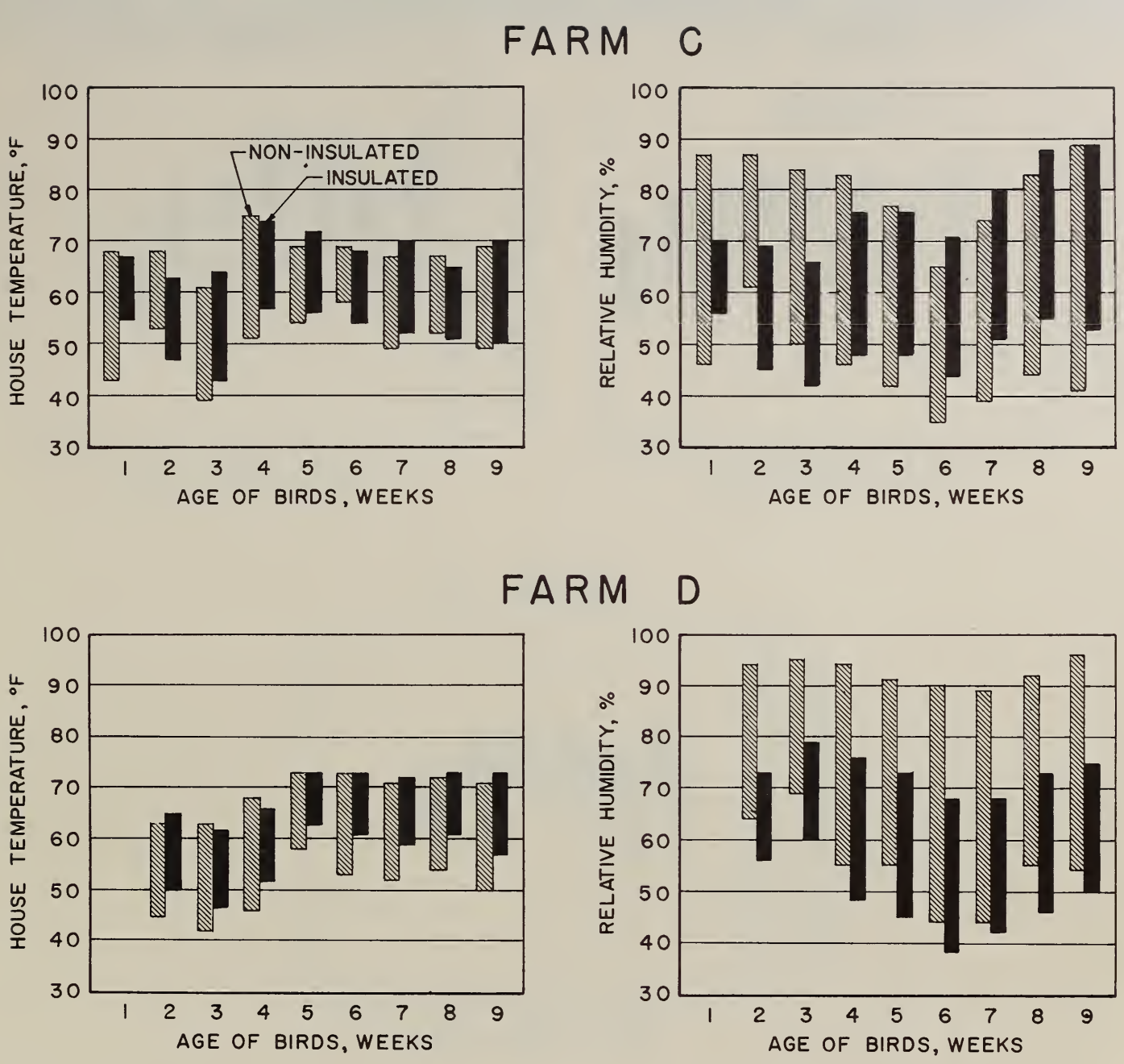

Figure 2. (cont'd.) Comparison between noninsulated and insulated broiler house temperatures and relative humidities in the winter. Bars indicate the weekly average of the daily maximum and minimum.

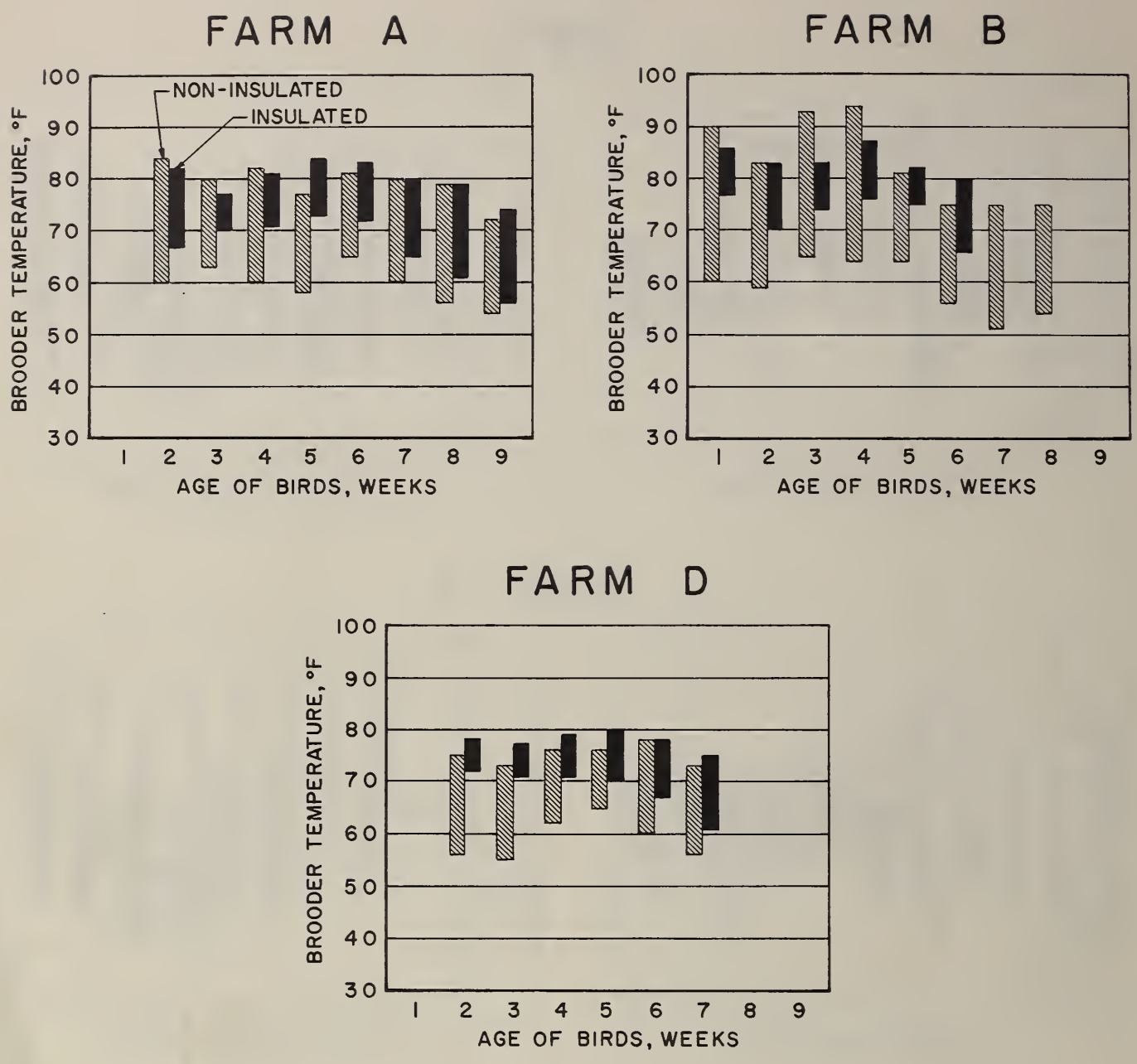

Figure 3. Comparison between the temperatures at the edge of brooder canopies in insulated and noninsulated broiler houses in the winter season.